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IS 11699 (1986): Steel Plug Valves for Petroleum, Petrochemical and Allied Industries [MED 17: Chemical Engineering Plants and Related Equipment]

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Bhartṛhari—Nītiśatakam

“Knowledge is such a treasure which cannot be stolen”





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*Indian Standard*

**SPECIFICATION FOR  
STEEL PLUG VALVES FOR PETROLEUM,  
PETROCHEMICAL AND ALLIED INDUSTRIES**

**1. Scope** — Specifies requirements for carbon and alloy steel, lubricated and soft seated plug valves with flanged, butt-welded, screwed or socket weld ends in nominal sizes DN 6 to DN 600 as in IS : 9520-1980 'Nominal sizes for valves'.

**1.1** This standard covers valves in nominal pressure ratings Class 150, 300, 600, 900, 1500, 2500 — flanged and butt welding, and Class 800, 1500 — screwed and socket welding.

**2. Nominal Sizes**

**2.1** The nominal size for flanged and butt welding ends shall be as follows:  
15, 20, 25, 32\*, 40, 50, 65\*, 80, 100, 150, 200, 250, 300, 350, 400, 450, 500, 600.

**2.2** The nominal size for the screwed and socket weld ends are as follows:  
 $\frac{1}{4}$ ,  $\frac{3}{8}$ ,  $\frac{1}{2}$ ,  $\frac{5}{8}$ , 1,  $1\frac{1}{4}$ \*,  $1\frac{1}{2}$ , 2.

**3. Nomenclature** — The standard nomenclature for valve parts is shown in Fig. 1 and 2.

**4. Definitions** — For the purpose of this standard, the following definitions shall apply.

**4.1 Lubricated Plug Valve** — A valve having the mating surfaces of the plug and body separated from each other by a pressurized, renewable film of lubricant/sealant ( see Fig. 1 ).

**4.2 Soft Seated Plug Valve** — A non-lubricated valve having soft seats of a low friction material fitted between the body and plug ( see Fig. 2 ).

**4.3 Lined Plug Valve** — A valve having a fully moulded bonded or keyed non-removable lining on all internal wetted surfaces that may be lubricated or non-lubricated.

**4.4 Short Pattern Plug Valve** — A valve having face-to-face dimensions as specified in IS : 9884-1981 'Dimensions for ferrous valves — face-to-face and end-to-end'.

**4.5 Venturi Plug Valve** — A valve having reduced port area and a body throat approximating a venturi.

**4.6 Regular Plug Valve** — A valve generally having ports of greater area than short or venturi patterns.

**5. Pressure/Temperature Ratings**

**5.1** With the exception of seats and seals, all valve components shall be capable of withstanding the pressure/temperature ratings of the body for the class of valve concerned. For Class 800, the body ratings are as indicated in Table 1.

**5.2** Maximum permissible working pressure in bar gauge and operating temperatures shall comply with the requirements for the shell material for the class of valve concerned except that they may be limited by the materials of the body linings and lubricants, seat rings, and/or seals. Due to the variety of lining and lubricant materials, it will be necessary to refer to the manufacturer's recommendations for pressure/temperature ratings. Seals, however, shall be capable of withstanding the body test pressures.

**5.3 Soft Seat Valves** — The pressure/temperature ratings for soft seat valves shall be established according to the material of the seats. The minimum pressure/temperature ratings of the valve seats shall comply with the requirements specified in Table 2.

**6. Design**

**6.1 Body**

**6.1.1** Body wall thickness shall be as given in Table 3.

\*Non-preferred.

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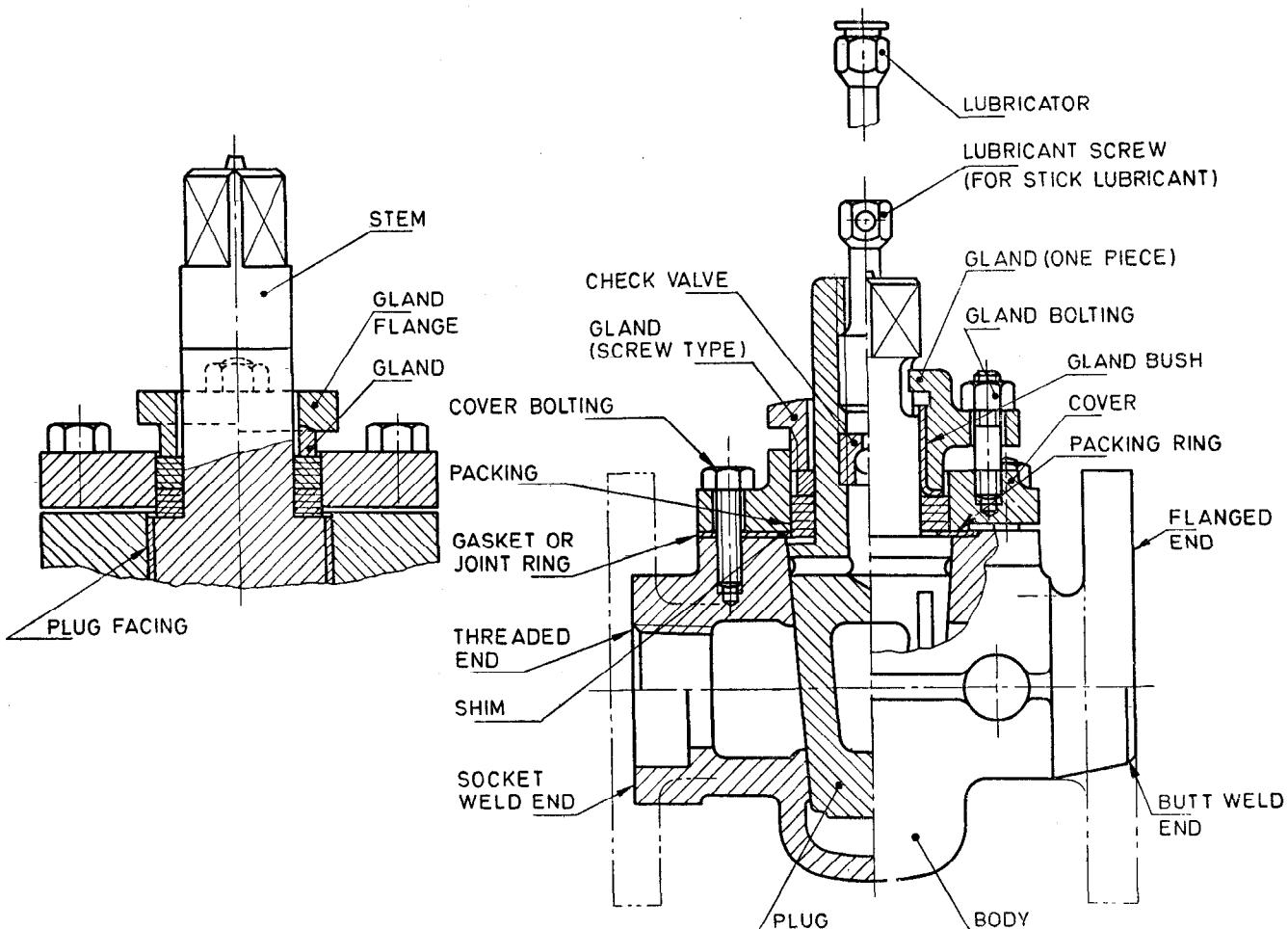


FIG. 1 LUBRICATED PLUG VALVE, TAPER PLUG, SHOWING CONSTRUCTIONAL VARIATIONS

**6.1.2** Drilling of or pinning to the wall of a pressure containing part for nameplate fixing or other purposes, shall not reduce the thickness below the minimum permitted value.

**6.1.3** Recesses or grooves on the inside of the body for the purpose of keying or restraining lining or sleeve shall not reduce the metal thickness below the minimum permitted value.

**6.1.4** Face-to-face dimensions for raised face flanged end valves and end-to-end dimensions for butt welding end and ring joint flanged and valves shall conform to IS : 9884-1981.

**6.1.5** End flanges shall be cast or forged integral with the body except that flanges may be attached by welding if so specified in the purchase order. End flanges attached by welding shall be butt welding type and the welds including qualification of welding procedure and welding operator shall be as specified in IS : 2825-1969 'Code for unfired pressure vessels'.

**6.1.6** End flange dimensions shall be as specified in Indian Standard specification for steel pipe flanges and flanged fittings, for the facing specified in the purchase order.

**6.1.7** Facing finish of raised faced and flanges shall be serrated with 24 to 40 grooves ( 0.60 to 1.0 mm pitch ) cut spirally or concentrically with a round nose tool with 1.6 mm or larger radius. The resultant surface finish shall have 3.2 to 12.5  $\mu\text{m}$  roughness. Other end flanges facing shall be as specified by the purchaser or latest accepted standard.

**6.1.8** Butt welding ends shall be as given in Indian Standard specification for butt welding ends.

**6.1.9** Socket weld end details shall be in accordance with requirements specified in IS : 4712-1968 'Dimensions for forged steel socket welding fittings'. Socket end wall thickness shall not be less than 1.09 times the nominal wall thickness of schedule 80 pipe for Class 800 valves and schedule 160 pipe for Class 1500 valves.

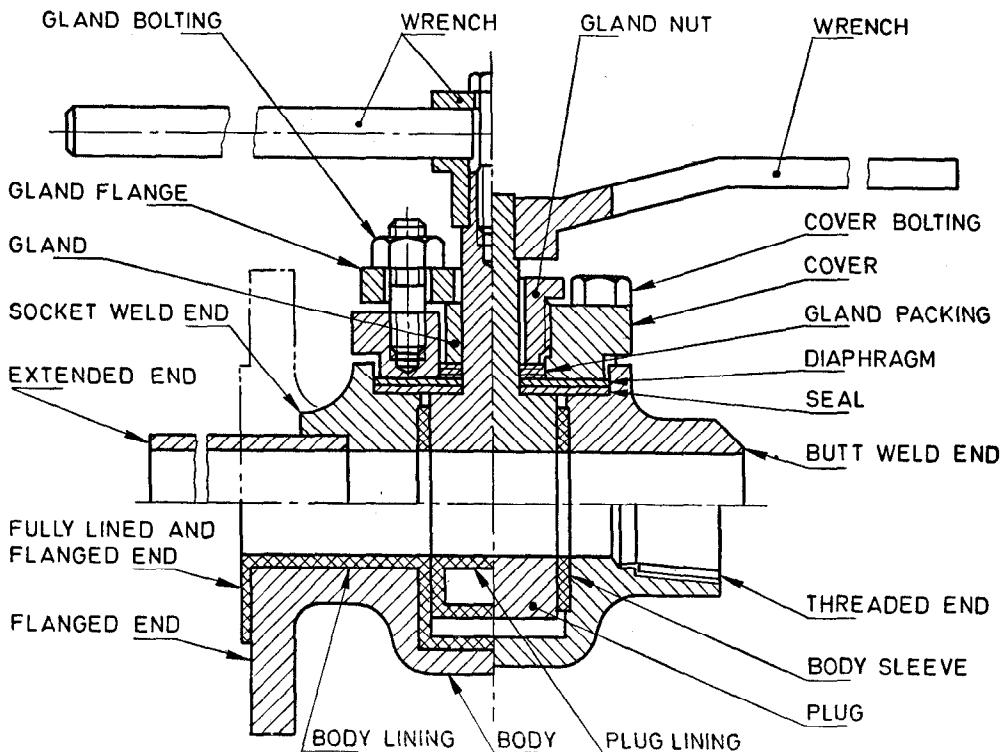


FIG. 2 SOFT SEATED PLUG VALVE

**6.1.10** The overall length of soft seated extended weld end valves shall be 400 mm and with a tolerance of  $\pm 1$  mm; valves of nominal sizes DN 15 to DN 40 shall have ends square or prepared for welding; valves of nominal size DN 50 shall have bevelled ends.

**6.1.11** Drain and by-pass connections, when specified, shall conform to IS : 9625-1980 'Locations of by-pass and drain connections for valve'.

## 6.2 Cover

**6.2.1** The design of the cover and cover joint shall be suitable for the pressure-temperature rating of the valve.

**6.2.2** Cover faces shall be spot faced or backfaced.

**6.2.3** Bolted covers shall be provided with bolts, stud bolts, studs, hexagon head screws, or socket head cap screws.

## 6.3 Plug and Stem (or Shank)

**6.3.1** The stem may be integral with the plug or separate from it. In either case the stem, or connection between the stem and plug, shall be designed to resist permanent distortion under any reasonable maximum turning load.

**6.3.2** Means other than adjustable gland components shall be provided to retain the stem.

## 6.4 Gland

**6.4.1** Glands may be of either the screwed, bolted solid, or bolted two-piece self-aligning type.

**6.4.2** Gland studs shall pass through holes in the gland. The use of open slots is not permitted in either the body or the gland.

**6.5 Lubricated Valves** — Lubricated valves shall be provided with a lubricant screw for stick type lubricants or lubricator for grease gun feed or stick type lubricant. In all cases a check valve shall be provided.

**TABLE 1 RATING FOR CLASS 800 BODY**  
(*Clause 5.1*)

| Grade                  | Carbon Steel                            | 5% Cr<br>½% Mo | 1½% Cr<br>½% Mo | 2½% Cr<br>1% Mo | 18/8 | 18/8<br>Low C | 18/10/2 | 18/10/2<br>Low C | 18/8Ti | 18/8/N6 |
|------------------------|---|----------------|-----------------|-----------------|------|---------------|---------|------------------|--------|---------|
| Service Temperature °C | Maximum non-shock service pressure, bar |                |                 |                 |      |               |         |                  |        |         |
| -30 to 38              | 138                                     | 138            | 138             | 138             | 118  | 98            | 139     | 98               | 138    | 138     |
| 50                     | 137                                     | 137            | 137             | 137             | 115  | 98            | 137     | 98               | 137    | 137     |
| 75                     | 135                                     | 135            | 135             | 135             | 110  | 98            | 135     | 98               | 135    | 135     |
| 100                    | 133                                     | 133            | 133             | 133             | 103  | 98            | 133     | 98               | 133    | 133     |
| 125                    | 132                                     | 132            | 132             | 132             | 98·5 | 97·5          | 132     | 97·5             | 132    | 132     |
| 150                    | 130                                     | 130            | 130             | 130             | 94·5 | 95            | 130     | 91·5             | 130    | 130     |
| 175                    | 129                                     | 129            | 129             | 129             | 90·5 | 89            | 129     | 84               | 129    | 129     |
| 200                    | 128                                     | 128            | 128             | 128             | 86·5 | 82            | 128     | 77               | 128    | 128     |
| 225                    | 125                                     | 125            | 125             | 125             | 83·5 | 76            | 125     | 77·5             | 125    | 125     |
| 250                    | 122                                     | 122            | 122             | 122             | 80   | 70            | 122     | 71               | 122    | 122     |
| 275                    | 116                                     | 116            | 116             | 116             | 77·5 | 66·5          | 116     | 68               | 116    | 116     |

**TABLE 2 MINIMUM PRESSURE/TEMPERATURE RATINGS OF VALVE SEATS**  
(*Clause 5.3*)

| Nominal Size of Valve DN | Minimum non-shock pressure rating, bar |    |    |     |     |     |     |     |
|--------------------------|--|----|----|-----|-----|-----|-----|-----|
|                          | At service temperature °C              |    |    |     |     |     |     |     |
|                          | 40                                     | 50 | 75 | 100 | 125 | 150 | 175 | 200 |
| 8 to 150                 | 48                                     | 47 | 43 | 39  | 36  | 32  | 29  | 25  |
| 200 to 300               | 35                                     | 34 | 31 | 28  | 25  | 23  | 20  | 17  |

**6.6 Soft Seated Valves** — Soft seats shall be suitably secured or retained to prevent movement between the seat and plug/body or body lining. Soft seats shall normally be renewable, unless otherwise stated by the purchaser.

TABLE 3 BODY WALL THICKNESS

(Clause 6.1.1)

All dimensions in millimetres.

| Nominal Size of Valve DN | Minimum Body Thickness |           |           |           |           |           |            |            |
|--------------------------|------------------------|-----------|-----------|-----------|-----------|-----------|------------|------------|
|                          | Class 150              | Class 300 | Class 400 | Class 600 | Class 800 | Class 900 | Class 1500 | Class 2500 |
| 8                        | —                      | —         | —         | —         | 3·3       | —         | —          | —          |
| 10                       | —                      | —         | —         | —         | 3·5       | —         | —          | —          |
| 15                       | 4·0                    | 4·0       | —         | 5·0       | 4·0       | —         | 6·0        | —          |
| 20                       | 4·0                    | 4·0       | —         | 5·0       | 4·3       | —         | 7·0        | —          |
| 25                       | 5·0                    | 6·0       | —         | 6·0       | 5·0       | —         | 8·0        | —          |
| 32                       | 6·0                    | 7·0       | —         | 7·0       | 5·6       | —         | 10·0       | —          |
| 40                       | 6·0                    | 7·0       | —         | 7·0       | 5·6       | —         | 12·0       | —          |
| 50                       | 7·0                    | 8·0       | —         | 8·0       | 6·1       | —         | 14·0       | —          |
| 65                       | 7·0                    | 8·0       | —         | 9·0       | —         | —         | 16·0       | 23·0       |
| 80                       | 7·0                    | 9·0       | —         | 10·0      | —         | 13·0      | 20·0       | 26·0       |
| 100                      | 8·0                    | 10·0      | 12·0      | 12·0      | —         | 16·0      | 23·0       | 32·0       |
| 150                      | 9·0                    | 12·0      | 16·0      | 16·0      | —         | 22·0      | 32·0       | 44·0       |
| 200                      | 10·0                   | 14·0      | 16·0      | 20·0      | —         | 26·0      | 40·0       | 56·0       |
| 250                      | 11·0                   | 16·0      | 18·0      | 23·0      | —         | 31·0      | 48·0       | 70·0       |
| 300                      | 12·0                   | 18·0      | 23·0      | 27·0      | —         | 36·0      | 55·0       | 81·0       |
| 350                      | 13·0                   | 20·0      | 25·0      | 29·0      | —         | —         | 60·0       | —          |
| 400                      | 14·0                   | 22·0      | 26·0      | 32·0      | —         | —         | 68·0       | —          |
| 450                      | 15·0                   | 23·0      | 28·0      | 35·0      | —         | —         | —          | —          |
| 500                      | 16·0                   | 25·0      | 31·0      | 38·0      | —         | —         | —          | —          |
| 600                      | 18·0                   | 28·0      | 34·0      | 44·0      | —         | —         | —          | —          |

## 6.7 Operation

### 6.7.1 Manual operation

**6.7.1.1 Wrench length** — The length of the wrench or the diameter of the wheel shall be such that a force not exceeding 350 N is required to operate the valve from either its open or closed position under the maximum differential pressure recommended by the manufacturer.

**6.7.1.2 Mounting of wrenches** — Wrenches shall be designed so that they are mounted parallel to the flow passage of the plug.

**6.7.1.3 Direction of operation** — The valve shall be closed by turning the wrench or the handwheel in a clockwise direction. Handwheels shall be suitably marked with an arrow and the words 'close' or 'shut' to indicate the direction of valve closing.

**6.7.1.4 Fitting of handwheels and wrenches** — Handwheels and wrenches shall be fitted in such a way that, whilst held securely, they may without dismantling any other parts of the valve, be removed and replaced when necessary.

**6.7.1.5 Stops** — Suitable stops capable of withstanding the full operating torque shall be provided for both fully open and fully closed positions of the valve.

**6.7.1.6 Indication of port position** — Stems, plug shanks, stem extensions, or other attachments shall be provided with permanent means of indicating port position and shall be designed positively to prevent mis-orientation.

**6.7.2 Drive operation** — If drive operation is used, it shall be by gear, actuator or chainwheel.

#### **6.8 Anti-static Device**

**6.8.1** All valves shall incorporate suitable features in their design to ensure electrical continuity between the plug, stem and body of the valve. The essential features of any device shall also fulfil the following requirement.

**6.8.2** The device shall have a discharge path from the plug to the stem and from the stem to the valve body with an electrical resistance of not greater than 10 ohms when the valve is new.

**6.8.3** The device shall be of such a design that the valve cannot be assembled or re-assembled without the device.

### **7. Material**

**7.1 Shell** — The shell comprising the body and cover shall be of the material specified in the purchase order. The material may be cast or forged unless a preference is specified in the purchase order.

**7.1.1** The cover may be made of suitable wrought steel in place of the comparable cast or forged steel when specified in the purchase order.

**7.2 Plug and Shank or Stem** — The plug and shank or stem shall be of a material at least equivalent to that of the body and may be heat-treated or hardened. For Class 150 carbon steel valves the plug may be of cast iron with properties not less than those of grade FG 180 as specified in IS : 210-1978 'Specification for grey iron castings (*third revision*)'.

**7.2.1** Where agreed between the supplier and the purchaser, plugs for carbon steel valves of other pressure classes may be supplied in cast iron with properties not less than those of grade FG 260 as specified in IS : 210-1978.

**7.2.2** Steel plugs may be hardened by heat treatment or the surface of steel plugs may be hard faced to provide desired abrasion resistance and proper hardness differential.

**7.3 Soft Seat Parts** — Where soft seated valves are supplied, soft seat parts shall be manufactured from PTFE oil-free granular resins, without fillers, which shall be virgin material free of any reclaimed processed material.

**7.4 Lining** — Where line valves are supplied the lining material shall be suitable for the service for which the valve is to be used.

**7.5 Operating Mechanisms** — Wrenches, handwheels and chainwheels, when specified in the purchase order, shall be of steel, malleable iron, or ductile iron. Cast iron materials shall not be used. Chains shall be of steel.

**7.6 Gland** — A one-piece gland or any gland flange shall be of steel. The bushing of a one-piece bushed gland or the gland proper of a two-piece gland shall be made of a material having a melting point above 955°C.

**7.7 Cover Seals and Gaskets** — Materials shall be suitable for use at operating temperatures up to 350°C or for soft seat valves, a minimum of 200°C.

**7.7.1** They shall also be suitable for the pressure/temperature rating of the valves. Any metallic part of the gasket shall have at least the same corrosion resistance as the shell.

#### **7.8 Bolting**

**7.8.1** The material for bolting for pressure containing parts shall conform to Gr 40Cr4Mo3 of IS : 1570.

Nuts meetings requirements of Grade 45C8 or 55C8 of IS : 1570 shall be furnished. If any other material is required, the same shall be specified in the purchase order.

**7.8.2 Gland materials** — The material for gland and other bolting shall have a minimum tensile strength of 430 N/mm<sup>2</sup>, except that for Class 150 valves carbon steel bolting of minimum tensile strength 390 N/mm<sup>2</sup> is permitted.

### 7.9 Nameplates

**7.9.1** For valves 150 mm and larger, nameplate material shall be 18-8 Cr-Ni, Steel or nickle alloy. The nameplate shall be attached to the valve by pins of similar material or by welding.

**7.9.2** For valves 100 mm and smaller, nameplate material and attachment shall be as per the manufacturer's standard, using a metal resistant to atmospheric corrosion. Brass or aluminium are acceptable.

**7.10 Lubricants** — Lubricated valves shall be fully charged with a lubricant for the service specified in the purchase order. If the service is not specified, the valves shall be fully charged with manufacturer's standard multi-purpose lubricant.

Lubricants may be of stick form or for grease gun application.

## 8. Inspection and Test

**8.1** If inspection is specified in purchase order, it shall be inspected in accordance with IS : 8157-1981 'Specification for valves inspection and test (*first revision*)'.

**9. Marking** — Valves shall be marked in accordance with IS : 9866-1981 'Marking system for valves'.

**9.1 Certification Marking** — Details available with the Bureau of Indian Standards.

## 10. Preparation for Despatch

**10.1** After testing, each valve shall be drained, cleaned, prepared and suitably protected for despatch in such a way as to minimize the possibility of damage and deterioration during transit and storage.

**10.2** Unmachined external surfaces shall be painted or rustproofed except for austenitic steel valves which may be left in their natural state.

**10.3** Machined or threaded surfaces shall be coated with an easily removable rust preventive except for austenitic steel valves.

**10.4** All plugs shall be in the open position when despatched.

**10.5** Body ends shall be suitably sealed to exclude foreign matter during transit and storage.

## 11. Information to be supplied by the purchaser along with enquiry or order:

- a) Type of valve required;
- b) Class designation and nominal diameter (DN) of the valve;
- c) End connections:
  - i) If flanged ends are required, state type of facing required, or
  - ii) If butt welding ends are required, state particulars of the pipe or wall thickness and outside diameter of the pipe;
- d) The shell material and the trim material;
- e) Whether a loading spring is required; and
- f) State if any of the following is required:
  - i) By-pass arrangement,
  - ii) Drain connection,
  - iii) Outside attachment or damping device, and
  - iv) Any additional marking.

**12. Guarantee** — The manufacturer shall by acceptance of the purchaser's order, guarantee the material, the design and the operation of the valves covered by the order to the extent, that, if any defect attributable to faulty workmanship, design or material are found in the valves within a period of one year after they are placed in regular service or 18 months ( whichever is less ) from the date of receipt of the valves, the manufacturer will furnish free of charge at the original point of delivery, any part or parts thereof that prove defective, provided the valves have not been misused or abused and have been installed in service for which they are recommended. If any valve is found to be defective prior to placement in service, the same shall be replaced by the manufacturer free of cost.

#### **EXPLANATORY NOTE**

In the preparation of this standard assistance has been derived from BS 5353-1980 'Specification for plug valves' issued by, the British Standards Institution and API 599 Steel plug valves ( flanged or butt welding ends) and API-600 Steel gate valves ( flanged or butt welding ends ), issued by American Petroleum Institute.